Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	("5751629").PN.	USPAT; EPO	OR	OFF	2005/02/04 09:57
L2	4783	latex same (microwell or reservoir or channel or microfluidic or wall)	US-PGPUB; USPAT; EPO; DERWENT	OR	OFF	2005/02/04 09:58
L3	1847	latex near10 (microwell or reservoir or channel or microfluidic or wall)	US-PGPUB; USPAT; EPO; DERWENT	OR	ON	2005/02/04 09:58
L4	14	l3 and biofilm	US-PGPUB; USPAT; EPO; DERWENT	OR	ON	2005/02/04 10:03
L5	404	(528/934,935,936,937,938).CCLS.	USPAT; EPO	OR	OFF	2005/02/04 10:04
L6	0	l5 and biofilm	USPAT; EPO	OR	OFF	2005/02/04 10:05
L7	17	l5 and (tube or microwell or channel or reservoir or chamber)	USPAT; EPO	OR	OFF	2005/02/04 11:04
L8	378	lewandowski.in.	USPAT; EPO	OR	OFF	2005/02/04 11:04
L9	0	l8 and biofilm	USPAT; EPO	OR	OFF	2005/02/04 11:04

```
=> file .meeting
'EVENTLINE' IS NOT A VALID FILE NAME
Enter "HELP FILE NAMES" at an arrow prompt (=>) for a list of files
that are available.  If you have requested multiple files, you can
specify a corrected file name or you can enter "IGNORE" to continue
accessing the remaining file names entered.
ENTER A FILE NAME OR (IGNORE):ignore
COST IN U.S. DOLLARS                                SINCE FILE      TOTAL
                                                       ENTRY    SESSION
FULL ESTIMATED COST                                     0.21       0.21

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=> lewandowski z/au
L1            1 FILE AGRICOLA
L2           75 FILE BIOTECHNO
L3            9 FILE CONFSCI
L4            0 FILE HEALSAFE
'AU' IS NOT A VALID FIELD CODE
L5            0 FILE IMSDRUGCONF
L6           39 FILE LIFESCI
'AU' IS NOT A VALID FIELD CODE
L7            0 FILE MEDICONF
L8           66 FILE PASCAL

TOTAL FOR ALL FILES
L9          190 LEWANDOWSKI Z/AU

=> l9 and biofilm
L10           1 FILE AGRICOLA
L11          54 FILE BIOTECHNO
L12           3 FILE CONFSCI
L13           0 FILE HEALSAFE
L14           0 FILE IMSDRUGCONF
L15          32 FILE LIFESCI
L16           0 FILE MEDICONF
L17          41 FILE PASCAL
```

TOTAL FOR ALL FILES
L18 131 L9 AND BIOFILM

=> l18 and reactor
L19 0 FILE AGRICOLA
L20 8 FILE BIOTECHNO
L21 0 FILE CONFSCI
L22 0 FILE HEALSAFE
L23 0 FILE IMSDRUGCONF
L24 6 FILE LIFESCI
L25 0 FILE MEDICONF
L26 4 FILE PASCAL

TOTAL FOR ALL FILES
L27 18 L18 AND REACTOR

=> dup rem
ENTER L# LIST OR (END):l27
DUPLICATE IS NOT AVAILABLE IN 'IMSDRUGCONF, MEDICONF'.
ANSWERS FROM THESE FILES WILL BE CONSIDERED UNIQUE
PROCESSING COMPLETED FOR L27
L28 11 DUP REM L27 (7 DUPLICATES REMOVED)

=> d l28 ibib abs total

L28 ANSWER 1 OF 11 LIFESCI COPYRIGHT 2005 CSA on STN
ACCESSION NUMBER: 2004:92711 LIFESCI
TITLE: Dynamics of lead immobilization in sulfate reducing **biofilms**
AUTHOR: Beyenal, H.; **Lewandowski, Z.**
CORPORATE SOURCE: Center for Biofilm Engineering, Montana State University, P. O. 173980, Bozeman, MT 59717, USA; E-mail: zl@erc.montana.edu
SOURCE: Water Research [Water Res.], (20040600) vol. 38, no. 11, pp. 2726-2736.
ISSN: 0043-1354.
DOCUMENT TYPE: Journal
FILE SEGMENT: A
LANGUAGE: English
SUMMARY LANGUAGE: English
AB We have evaluated the effects of selected minerals present in subsoil environment on the efficiency of lead removal from contaminated groundwaters using **biofilms** composed of sulfate-reducing microorganisms, and examined the stability of metal deposits after the **biofilms** had been temporarily exposed to the air. To quantify the studied effects, lead was immobilized in **biofilms** of Desulfovibrio desulfuricans grown anaerobically in two flat-plate flow **reactors**, one filled with hematite and the other with quartz. While the **biofilms** in both **reactors** were heterogeneous and consisted of voids and channels, the **biofilms** grown on hematite were denser, thicker, and more porous than those grown on quartz. The average H sub(2)S concentrations, measured using microelectrodes, were higher in the **biofilms** grown on quartz than those measured in the **biofilms** grown on hematite. During 18 weeks of operation, iron was continuously released from the hematite. Lead was immobilized more efficiently in the **biofilms** grown on quartz than it was in the **biofilms** grown on hematite. Lead deposits were partially reoxidized, especially in **biofilms** grown on hematite, and the **biofilms** in both **reactors** responded to the presence of oxygen by lowering their density and increasing the H sub(2)S production rate.

L28 ANSWER 2 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
DUPLICATE

ACCESSION NUMBER: 2001:32885600 BIOTECHNO
TITLE: Growing reproducible **biofilms** with respect to structure and viable cell counts
AUTHOR: Jackson G.; Beyenal H.; Rees W.M.; **Lewandowski Z.**
CORPORATE SOURCE: Z. Lewandowski, Center for Biofilm Engineering, Montana State University, PO Box 173980, Bozeman, MT 59717-3980, United States.
E-mail: ZL@erc.montana.edu
SOURCE: Journal of Microbiological Methods, (2001), 47/1 (1-10), 21 reference(s)
CODEN: JMIMDQ ISSN: 0167-7012
PUBLISHER ITEM IDENT.: S0167701201002809
DOCUMENT TYPE: Journal; Article
COUNTRY: Netherlands
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 2001:32885600 BIOTECHNO
AB We have developed a new method of growing 4-day-old **biofilms** that are reproducible, with respect to viable cell number and **biofilm** structure. To demonstrate the utility of the method, we grew **biofilms** composed of Pseudomonas aeruginosa (ATCC#700829), P. fluorescens (ATCC#700830) and Klebsiella pneumoniae (ATCC#700831), 18 times in flat-plate **reactors** under well-defined conditions of: flow rate, nutrient concentration, temperature, inoculum and growth rate. The resulting 4-day-old **biofilms** were approximately 200-300 μm thick and exhibited a high degree of reproducibility. The number of viable cells that accumulated per unit surface area and the **biofilm** areal porosity were reproduced within 10% error. We have also quantified other parameters characterizing **biofilm** structure using **biofilm**-imaging techniques: fractal dimension, textural entropy and diffusion distance as auxiliary parameters characterizing the reproducibility of **biofilm** accumulation. As a result of analysis, we have introduced a new parameter to better quantify and characterize the number of viable cells in **biofilms**, "specific number of viable cells" (SNVC). This parameter is the viable cell number normalized with respect to the surface area covered by the **biofilm** and with respect to the biomass of the **biofilm**. This new descriptor represents the dynamics of **biofilm** accumulation better than the traditionally used colony-forming unit (CFU) per surface area covered by the **biofilm** because it accounts not only for the surface coverage but also for the **biofilm** thickness.

L28 ANSWER 3 OF 11 BIOTECHNO
ACCESSION NUMBER: 2000:30211692 BIOTECHNO
TITLE: Notes on **biofilm** porosity
AUTHOR: **Lewandowski Z.**
CORPORATE SOURCE: Z. Lewandowski, Department of Civil Engineering, Center for Biofilm Engineering, Montana State University, Bozeman, MT 59717, United States.
E-mail: zl@erc.montana.edu
SOURCE: Water Research, (15 JUN 2000), 34/9 (2620-2624), 8 reference(s)
CODEN: WATRAG ISSN: 0043-1354
PUBLISHER ITEM IDENT.: S004313540000186X
DOCUMENT TYPE: Journal; Article
COUNTRY: United Kingdom
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 2000:30211692 BIOTECHNO
AB Difficulties have been encountered attempting to use porosity as a parameter for quantifying **biofilm** heterogeneity. Some of those difficulties are technical in nature-measurement of **biofilm**

porosity and interpretation of the results-while other are more fundamental and result from using the well-known concept of rigid porous bed porosity to describe the porosity of a gelatinous **biofilm** matrix. Possible remedies are suggested and discussed. Copyright (C) 2000 Elsevier Science Ltd.

L28 ANSWER 4 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
DUPLICATE
ACCESSION NUMBER: 1998:28528970 BIOTECHNO
TITLE: The accuracy of oxygen flux measurements using microelectrodes
AUTHOR: Rasmussen K.; **Lewandowski Z.**
CORPORATE SOURCE: Z. Lewandowski, Center For Biofilm Engineering, 409 Cobleigh Hall, Montana State University - Bozeman, PO Box 173980, Bozeman, MT 59717-3980, United States.
SOURCE: Water Research, (1998), 32/12 (3747-3755), 40 reference(s)
CODEN: WATRAG ISSN: 0043-1354
PUBLISHER ITEM IDENT.: S0043135498001493
DOCUMENT TYPE: Journal; Article
COUNTRY: United Kingdom
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 1998:28528970 BIOTECHNO
AB An electrochemical analog of a **biofilm** was constructed to test the accuracy of oxygen flux measurements using microelectrodes. We used a cathodically polarized graphite felt attached to the bottom of a flat plate open channel **reactor** as the reactive surface consuming oxygen. The oxygen flux to the felt was calculated from the polarization current. Microelectrodes were used to measure the oxygen profiles above and within the graphite felt. From the shape of the oxygen profile we evaluated the oxygen flux to the graphite felt. This provided us with two sets of data, the true oxygen flux, calculated from polarization current, and the oxygen flux estimated from microelectrode measurements. Comparing these two fluxes, for different flow velocities, showed that the fluxes evaluated from the polarization current were different from those evaluated from the oxygen profiles. The differences were likely caused by the presence of the microelectrode in the mass boundary layer and/or by the simplifying assumptions accepted in computational procedures employed to calculate oxygen fluxes. For low flow velocities, between zero and 1.0 cm s.sup.-.sup.1, the differences were velocity sensitive; the higher the flow velocity, the bigger the difference. For higher flow velocities, between 1 cm s.sup.-.sup.1 and 3 cm s.sup.-.sup.1, the flux of oxygen estimated from the microelectrode measurements was consistently approximately 80% higher than the true oxygen flux estimated from the polarization current.

L28 ANSWER 5 OF 11 PASCAL COPYRIGHT 2005 INIST-CNRS. ALL RIGHTS RESERVED. on STN
ACCESSION NUMBER: 1997-0357893 PASCAL
COPYRIGHT NOTICE: Copyright .COPYRGT. 1997 INIST-CNRS. All rights reserved.
TITLE (IN ENGLISH): Predictive model for toluene degradation and microbial phenotypic profiles in flat plate vapor phase bioreactor
AUTHOR: MIRPURI R.; SHARP W.; VILLAVERDE S.; JONES W.; **LEWANDOWSKI Z.**; CUNNINGHAM A.
CORPORATE SOURCE: 1345 Northland Dr., Basys Technologies, Mendota Heights, MN 55120, United States; Manufacturing Management Systems, Shell Services Co., Houston, TX 77077, United States; Dept. d'Enginyeria Quimica, Escola Tecnica Superior d'Enginyeria Quimica, Universitat Rovira i Virgili, 43006 Tarragona, Spain; CBE, Montana State Univ., Bozeman, MT 59717, United

States
SOURCE: Journal of environmental engineering : (New York, NY), (1997), 123(6), 586-592, 17 refs.
ISSN: 0733-9372 CODEN: JOEEDU
DOCUMENT TYPE: Journal
BIBLIOGRAPHIC LEVEL: Analytic
COUNTRY: United States
LANGUAGE: English
AVAILABILITY: INIST-572J, 354000061612370080
AN 1997-0357893 PASCAL

AB A predictive model has been developed to describe degradation of toluene in a flat-plate vapor phase bioreactor (VPBR). The VPBR model incorporates kinetic, stoichiometric, injury, and irreversible loss coefficients from suspended culture studies for toluene degradation by P putida 54G and measured values of Henry's law constant and boundary layer thickness at the gas-liquid and liquid-**biofilm** interface. The model is used to estimate the performance of the **reactor** with respect to toluene degradation and to predict profiles of toluene concentration and bacterial physiological state within the **biofilm**. These results have been compared with experimentally determined values from a flat plate VPBR under electron acceptor and electron donor limiting conditions. The model accurately predicts toluene concentrations in the vapor phase and toluene degradation rate by adjusting only three parameters: biomass density and rates of death and endogenous decay. Qualitatively, the model also predicts gradients in the physiological state cells in the **biofilm**. This model provides a rational design for predicting an upper limit of toluene degradation capability in a VPBR and is currently being tested to assess applications for predicting performance of bench and pilot-scale column **reactors**.

L28 ANSWER 6 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
DUPLICATE
ACCESSION NUMBER: 1997:27468932 BIOTECHNO
TITLE: Physiological and chemical gradients in a Pseudomonas putida 54G **biofilm** degrading toluene in a flat plate vapor phase bioreactor
AUTHOR: Villaverde S.; Mirpuri R.G.; **Lewandowski Z.**; Jones W.L.
CORPORATE SOURCE: Z. Lewandowski, Center for Biofilm Engineering, 366 EPS Building, Montana State University, Bozeman, MT 59717, United States.
E-mail: zl@erc.montana.edu
SOURCE: Biotechnology and Bioengineering, (1997), 56/4 (361-371), 51 reference(s)
CODEN: BIBIAU ISSN: 0006-3592
DOCUMENT TYPE: Journal; Article
COUNTRY: United States
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 1997:27468932 BIOTECHNO
AB A Pseudomonas putida 54G **biofilm** was grown on toluene vapor supplied as the sole external carbon and energy source in a flat plate **biofilm reactor**. Enumerations of cells in the **biofilm** were made using culture techniques (selective and nonselective for toluene) and microscopic techniques (total and respiring cells), and an analysis of the progression of the state of the culture was made by examination of various fractions of the populations. Long-term exposure to higher levels of toluene produced the following trends: (i) lower fraction of total cells that respired; (ii) lower fraction of culturable cells that also grew on toluene; (iii) higher fraction of respiring cells that could not grow on toluene plates; and (iv) a relatively constant fraction of total cells that could not be

cultured on toluene. Respiration rate was determined using oxygen microsensors, and the fraction of the total respiration that was not associated with toluene uptake increased with higher toluene exposure. A combination of cryosectioning and respiration rate data was used to demonstrate that more respiring cells and a higher respiration rate both occurred at the base of the film, suggesting a deterioration in physiological state with continued exposure to toluene.

L28 ANSWER 7 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
DUPLICATE
ACCESSION NUMBER: 1997:27432343 BIOTECHNO
TITLE: The effect of bacterial injury on toluene degradation and respiration rates in vapor phase bioreactors
AUTHOR: Jones W.L.; Mirpuri R.G.; Villaverde S.; **Lewandowski Z.**; Cunningham A.B.
CORPORATE SOURCE: W.L. Jones, Department of Civil Engineering, Montana State University, Bozeman, MT 59717-3980, United States.
SOURCE: Water Science and Technology, (1997), 36/1 (85-92), 19 reference(s)
CODEN: WSTED4 ISSN: 0273-1223
PUBLISHER ITEM IDENT.: S0273122397003260
DOCUMENT TYPE: Journal; Article
COUNTRY: United Kingdom
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 1997:27432343 BIOTECHNO
AB The effects of prolonged toluene exposure and degradation on bacterial cultures of Pseudomonas putida 54G were investigated in three **reactor** systems: a batch suspended culture system, a bench-scale flat plate **biofilm reactor**, and a bench-scale packed column **reactor**. Humidified air containing 150 ppmv (toluene limiting) to 750 ppmv (oxygen limiting) toluene vapor was the sole source of carbon and energy supplied to these systems. Results from the suspended batch culture experiments were used to develop rate expressions and kinetic parameters for loss of culturability and of toluene degradative capacity. Experiments in the flat plate **reactor** were carried out to examine the effects of injury on **biofilm** structure and function. The packed column studies were performed under conditions relevant to field application, and confirmed results from the other two studies - that decreased culturability on toluene media correlated with decreased specific toluene degradation rate, particularly at higher toluene concentration.

L28 ANSWER 8 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
ACCESSION NUMBER: 1995:25165518 BIOTECHNO
TITLE: Experimental and conceptual studies on mass transport in **biofilms**
AUTHOR: **Lewandowski Z.**; Stoodley P.; Altobelli S.
CORPORATE SOURCE: Center for Biofilm Engineering, Montana State University,Bozeman, MT 59717, United States.
SOURCE: Water Science and Technology, (1995), 31/1 (153-162)
CODEN: WSTED4 ISSN: 0273-1223
DOCUMENT TYPE: Journal; Conference Article
COUNTRY: United Kingdom
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 1995:25165518 BIOTECHNO
AB It is demonstrated that the flow velocity distributions in a flat plate **reactor** with and without **biofilm** are considerably different. Flow velocity profiles perpendicular to the channel wall indicate water movement in the space occupied by the **biofilm**. The flow velocity does not reach zero at the **biofilm** surface. Water flows through the pores in the **biofilm** causing convective

mass transport. Longitudinal profiles of the flow velocity indicate that the presence of the **biofilm** disturbs the flow, which increases the entry length required for fully developed viscous flow to be established. Recently it has been shown that **biofilms** consist of cell clusters separated by interstitial voids. This newly proposed concept of **biofilm** structure helps to explain these experimental observations. However, the hydrodynamics and mass transport in **biofilm** systems appear to be more complex than previously assumed.

L28 ANSWER 9 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
DUPLICATE
ACCESSION NUMBER: 1995:26095881 BIOTECHNO
TITLE: Flow induced vibrations, drag force, and pressure drop in conduits covered with **biofilm**
AUTHOR: **Lewandowski Z.**; Stoodley P.
CORPORATE SOURCE: Center for Biofilm Engineering, Montana State University,Bozeman, MT 59717, United States.
SOURCE: Water Science and Technology, (1995), 32/8 (19-26)
CODEN: WSTED4 ISSN: 0273-1223
DOCUMENT TYPE: Journal; Article
COUNTRY: United Kingdom
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 1995:26095881 BIOTECHNO
AB **Biofilm** was grown in closed conduit **reactors** under turbulent flow conditions. Structural development of the **biofilm** suggests that individual microcolonies behave like blunt bodies shedding vortices. The microcolonies assumed elongated forms, termed 'streamers', possibly because of an exerted pressure drag force. The streamers when entrained in the water flow vibrated rapidly dissipating kinetic energy from the bulk liquid. The energy was transferred through the **biofilm** causing the underlying microcolonies to oscillate. The measured pressure drop was partially attributed to the loss of energy due to these flow induced vibrations and oscillations.

L28 ANSWER 10 OF 11 BIOTECHNO COPYRIGHT 2005 Elsevier Science B.V. on STN
DUPLICATE
ACCESSION NUMBER: 1994:24242259 BIOTECHNO
TITLE: Liquid flow in **biofilm** systems
AUTHOR: Stoodley P.; DeBeer D.; **Lewandowski Z.**
CORPORATE SOURCE: Center for Biofilm Engineering, Montana State University,Bozeman, MT 59717, United States.
SOURCE: Applied and Environmental Microbiology, (1994), 60/8 (2711-2716)
CODEN: AEMIDF ISSN: 0099-2240
DOCUMENT TYPE: Journal; Article
COUNTRY: United States
LANGUAGE: English
SUMMARY LANGUAGE: English
AN 1994:24242259 BIOTECHNO
AB A model **biofilm** consisting of Pseudomonas aeruginosa, Pseudomonas fluorescens, and Klebsiella pneumoniae was developed to study the relationships between structural heterogeneity and hydrodynamics. Local fluid velocity in the **biofilm** system was measured by a noninvasive method of particle image velocimetry, using confocal scanning laser microscopy. Velocity profiles were measured in conduit and porous medium **reactors** in the presence and absence of **biofilm** . Liquid flow was observed within **biofilm** channels; simultaneous imaging of the **biofilm** allowed the liquid velocity to be related to the physical structure of the **biofilm**.

L28 ANSWER 11 OF 11 LIFESCI COPYRIGHT 2005 CSA on STN
ACCESSION NUMBER: 94:30909 LIFESCI

TITLE: Corrosion of mild steel underneath aerobic **biofilms** containing sulfate-reducing bacteria. Part 2: At high dissolved oxygen concentration

AUTHOR: Lee, Whonchee; **Lewandowski, Z.**; Morrison, M.; Characklis, W.G.; Avci, R.; Nielsen, P.H.

CORPORATE SOURCE: Cent. Interfacial Microb. Process Eng., Montana State Univ., Bozeman, MT 59717, USA

SOURCE: BIOFOULING, (1993) vol. 7, no. 3, pp. 217-239. ISSN: 0892-7014.

DOCUMENT TYPE: Journal

FILE SEGMENT: J

LANGUAGE: English

SUMMARY LANGUAGE: English

AB Microbial **biofilms** containing sulfate-reducing bacteria (SRB) and general anaerobic bacteria (GAB) were grown in a closed flow channel **reactor** in air-saturated bulk liquid. The SRB proliferated within anaerobic microniches even when dissolved oxygen penetrated the entire **biofilm** at some locations. Corrosion of mild steel during aerobic/anaerobic **biofilm** accumulation was classified as aerobic corrosion and SRB-enhanced corrosion. Aerobic corrosion dominated during the early stages of **biofilm** accumulation. The corrosion rate decreased as the **biofilm** became more uniform over the surface. SRB-enhanced corrosion occurred after the SRB community was established within the deposits and significant amounts of iron sulfides contacted the bare steel surface. The initiation and propagation of SRB-enhanced corrosion in an aerobic/anaerobic **biofilm** system was explained through the establishment of an FeS/Fe galvanic cell.